

THE APPLICATION OF A METHOD OF RAPID EVALUATION IN HUNGARIAN PALYNOLOGY

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I.

Palynological investigations are rather timeconsuming wherefore the attainment of results necessitating a thorough evaluation requires a long time. To obtain scientifically correct results in palaeobotany, it is necessary to employ this detailed, thorough way of working. Results thus obtained serve as the bases of palaeoecological, palaeogeographical, and last but not least of stratigraphical statements, the latter being useful in effecting reliable and fine stratigraphical subdivisions.

In case the palynologist is required to supply information to the geologist, the above method will lag far behind the work of the geologist evaluating the boring sample material. This is especially valid for deep borings serving routine industrial purposes.

As a consequence, repeated attempts have been made by palynologists — in view of the enormous requirements especially if there is no other palaeontological method which would yield the necessary results — to establish methods which supply the necessary information in a much smaller time.

Most of these attempts have the common feature that the material is not evaluated in its entirety. Either the vertical extension of some morphologically well-defined forms is taken into consideration, establishing some forms as characteristic of certain horizons or some pollen form groups are defined and the conclusions are drawn from the quantity relations of these groups. Examples for these methods are cited below:

1. Intent on simplification, REIN bases his evaluation method on twelve groups of pollen types which are counted out in populations containing a pollen spectrum of some 70 pollen types. On the one hand, he has chosen those well-defined types which have an abundance of at least five per cent and, on the other, those whose regular changes of abundance influence significantly the standard diagram. The curves of identical trend of the diagrams obtained by REIN's investigations were condensed by SITTLER to form standard diagrams and were applied to borings of different areas.

2. PFLUG illustrates in his diagrams for stratigraphical evaluation the leading fossils (Leitfossilien) and leading abundances (Leitfrequenz), taking into consideration some 30 form groups. In his diagrams he operates with relative abundances.

3. KRUTZSCH considers, similarly to PFLUG, to be most efficient or Cretaceous and Tertiary „leading fossils“ employed by the palaeontologists. He subjects some forms characteristic of the given horizon to a very thorough morphological study, establishing the age of the horizon in question by the presence or absence of groups of these forms.

4. JEKHOVSKY has described in several papers a new method of evaluation which is utilized in the palynological laboratories of the French oil industry. He distinguishes 11 form groups by simple morphological inspection and by drawing a diagram of their quantity relations establishes zones which can be utilized in stratigraphical parallelization.

The importance of rapid evaluation methods from the point of view of routine investigations is very great, wherefore it was deemed worth while to try out their utilization also in *Hungary*. I have attempted this in the course of evaluating the pollen material of the deep well *Hidas* No 53.

II.

The palynological evaluation of the 1126 metres deep well *Hidas* No 53 was a rare scientific and practical occasion, for the boring has traversed strata of the Pleistocene, Pannonian, Sarmatian, Tortonian, Helvetian, and after having traversed the Cretaceous trachydolerite, it penetrated into the deeper Mesozoic. This gave the first opportunity to study the pollen assemblages of the Neogene of *Mecsek* Mountains facies in their interrelations. The importance of the occasion is further enhanced by the fact that the boring samples are to be subjected to a complex evaluation in order that the palynological results might be correlated and checked by faunistical methods.

Naturally, for the geologist directing the boring and the mapping in an area, the stratigraphical evaluation is of the greatest interest. Therefore, the first thing to be cleared is whether the palynological results correlate with the horizons established by mollusks and by lithology.

The samples of the boring were taken after each change of lithology. They are consequently not equidistant, being spaced sometimes some centimetres, elsewhere 15 to 20 metres apart.

The first purpose of palynological analysis was in this case to obtain an overall picture of the profile, as soon as possible. Therefore I attempted not to lose myself in the detailed study of some horizon, but have chosen the samples so that they

- a) should be equidistant as far as possible,
- b) should be of sediments in which pollen content is most likely,
- c) should come from points vital from the point of view of problems of delimitation.

Preparation was done by the aid of several techniques, varying according to the nature of the lithology.

The reference preparates (embedded in glycerine jelly) were counted out, if possible, up to 150 specimens of Sporomorpha. Of the characteristic Sporomorpha, and other remains, I have prepared photos, so-called light sections under oil immersion, with the shifting of the tube in the downward sense. In this way it was possible to retain beside the morphological habit also the characteristics of the outer and inner lamellae of the exine, in dependence on their state of preservation.

III.

In choosing the rapid evaluation method I had to take into consideration that each of the above-mentioned methods is easier applied to older strata, partly because there the time units are longer, and partly because e. g. in the Cretaceous and at the beginning of the Tertiary there occur a great number of very characteristic, relatively short-lived forms, at the time of the sudden breakthrough of the Angiosperms. Therefore, for these intervals, the parallelization method resting on the recognition of a few forms can be employed to advantage.

I had to take further into consideration that after the upper cretaceous floral revolution the form richness of the material ebbed out, the form differences being treatly reduced, so that an accurate morphological description necessitates a thorough observation. It is to be pointed out that as contrary to the study of e. g. the German Tertiary, which is carried on by a great number of scientists and has a past of some thirty years, the study of the Tertiary in our country is no more than a decade old and must labor under the difficulties of dundament-laying.

Considering the above said, it seemed more practical to employ in the evaluation of the Miocene beds investigated by me a method based upon certain form assemblages.

As JEKHOWSKY stated that the method proposed by him gives rapid results, I have attempted its application. I had to administer some modifications, as the circumstances were not wholly identical. (Different sampling technique, younger sediments, shorter sedimentation cycles.)

The procedure employed by me was as follows: I have taken the sum total of the spore and pollen content and of the plankton organisms in the sample as one hundred per cent. I have condensed the main forms of greater abundance into eight morphological units.

1. Dissacites (Conifers with bladders)
2. Inaperturopollenites (Conifers without bladders)
3. Triporate forms
4. Tricolpate forms
5. Tricolporate forms
6. Monolete-monocolpate forms
7. Trilete forms
8. Hystricosphaerids and planktonic organisms.

The difference against JEKHOWSKY is that the second group consists exclusively of Conifers, without e. g. the rounded mycaceous spores. I have classed the planktonic organisms with Group 8 because the number of Hystricosphaerids was so small as to defy illustration.

I have illustrated the percentages above morphological groups of the as related to the sum total of Sporomorpha and planktonic organisms in hystograms, thereby indicating the lack of uniformity of sampling.

IV.

Comparing the values of the hystograms I have reached the conclusion that they yield by and large the geological subdivisions established by other methods.

By the pollen spectra I have distinguished in the Miocene-Pliocene series of about 1000 metres thickness (down to the Cretaceous trachydolerite) the zones A, B, C and D (*Diagram No 1*).

The „D“ zone contains beside the Pannonian also the upper part of the complex designated as Sarmatian (from Sample No 15 upwards). This zone is a unit sharply distinguished from the rest. The abundance of Dissacites is characteristic. The diagrams of the Angiosperms show two similar arcs (Triplicate, Tricolporate, and Tricolpate). Sample No 8 (from the section considered to be upper Pannonian by macropalaeontologists) represents a break due to the abundance of Trilete forms with a relative scarcity of Tricolporates. Above — just like in the section regarded as lower Pannonian — the Angiosperms turn up again, but with a smaller arc. This corresponds to the upper Pannonian. Spores as well as planktonic organisms are most abundant in the „A“ zone. — Considering the above-said, the zone A can be subdivided into three sub-zones: D₃ for Samples Nos 1 to 7, the separating sub-zone D₂ for Sample No 8 and the lower sub-zone D₁ for Samples Nos 9 and 13.

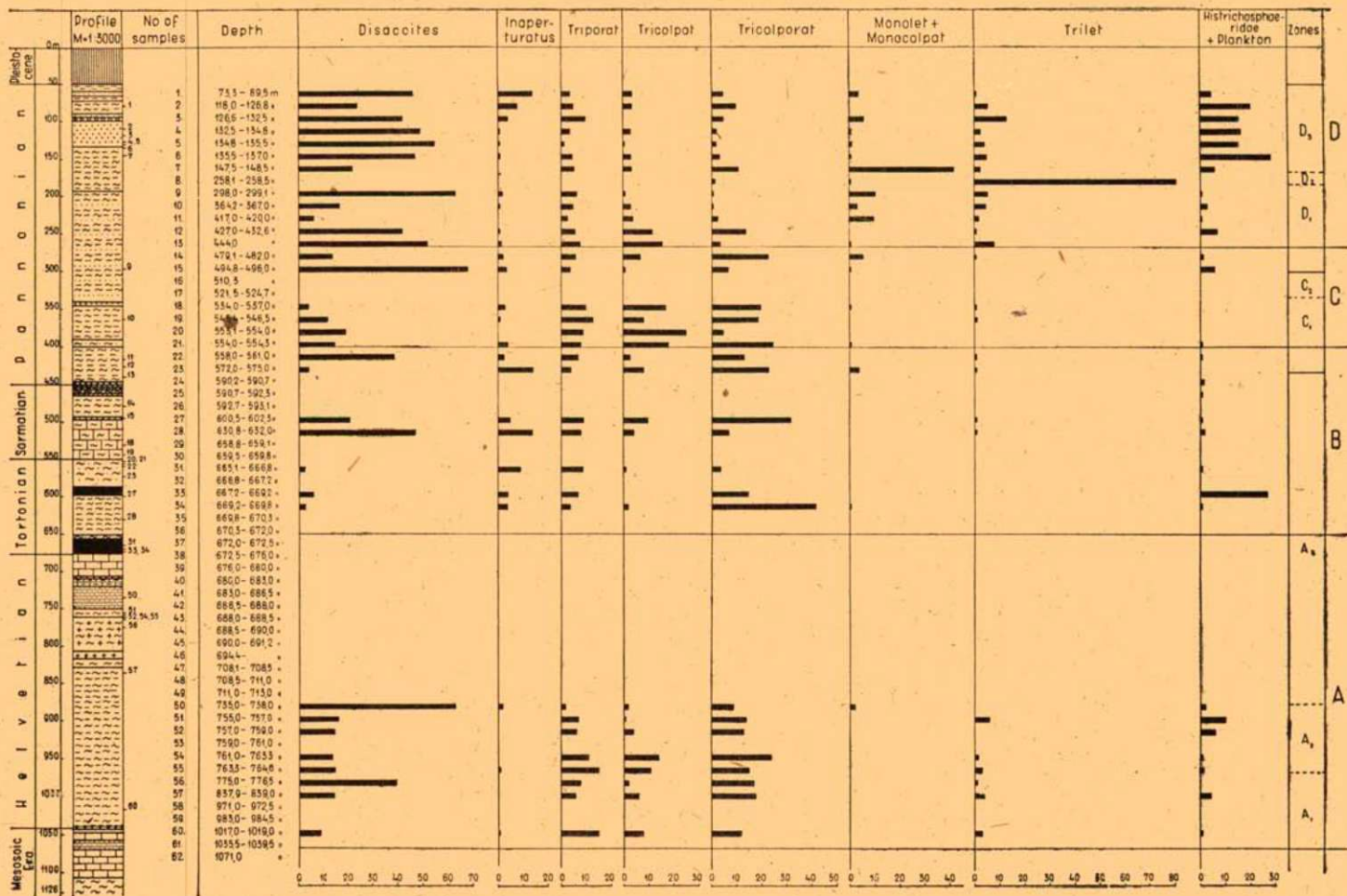
The „C“ zone comprises the sedimentation cycle represented by Samples Nos 16 to 23. It can be subdivided in two sub-zones: C₂ is pollen-free, characterized by a few Dissacites, while sub-zone C₁ is distinguished from the „D“ zone by the greater abundance of Angiosperms and by the scarcity of spores (Monoletes as well as Triletes) as well as of planktonic organisms.

The „B“ zone comprises the section between Samples Nos 24 and 36. It corresponds to the Tortonian lignitic-coaly sedimentation cycle. Even the pollen preparates indicate an oscillation here. The paralic origin of the lignitic coal samples is indicated by the presence of rich marine plankton beside the abundant tissue remains. Occasionally there occurs *Ovoidites ligneolus* R. Pat. indicative of fresh and brackish water (592,7—593,1 metres).

The pollen spectra forming the „A“ zone (Samples Nos 37 to 61) are readily distinguished from the „B“ zone comprising the Tortonian.

In the material of the A₃ sub-zone pollen is remarkably scarce and of rather bad preservation. The sub-zone comprises much limestone and sediments of calcareous cement, which fact explains the scarcity of pollen. The pollen spectrum of Sample Nos 50, from the depth of 735 to 738 metres, indicates clearly the great distance of the dry land, by the small abundance of Angiosperms beside the great abundance of bladdered Conifer pollen. The rest of the microremains (Hystrichosphaeridas, Foraminifera) also indicate a marine environment. In the sub-zone A₂, beside the almost uniform abundance of Dissacites, the reappearance of the Angiosperms is a characteristic feature as opposed to the „B“ zone. The first sub-zone of the „A“ zone is readily distinguished by the intensely corroded material and the presence of some new forms.

DIAGRAM OF THE DEEP WELL HIDAS 53



V.

Even the pollen spectra based upon a rather schematical morphological evaluation may supply interesting geohistorical evidence concerning the boring and its neighbourhood. The deeper Mesozoic age of the strata underlying the Cretaceous trachydolerite is proven beyond doubt by some corroded Conifer pollens of lower to upper Liassic age. (Sample from 1071 metres depth.)

The sample immediately overlying trachydolerite is exceptionally pollen-poor, with the scarce forms rather intensely corroded. This circumstance indicates the beginning of the transgression which has re-worked the terrestrial deposits. The pollen material of the samples relegated to the sub-zone A₂ is already richer, most of them being forms well known from the Miocene, which can be present in older as well as in younger Tertiary deposits (e. g. *Zelkova*, *Myrica*). However, part of the material is undoubtedly older than any of the Neogene forms I have encountered up to now. We can conclude therefrom that the mixed floral assemblage at the bottom of the sequence was washed together gradually by the incipient Helvetian transgression from the products of foregoing deposition.

At the time of deposition of the A₂ zone a sufficient amount of pollen was swept by the wind to our locality from the islands situated in the environment of the present-day Mecsek Mountains. The land could not have been situated too far away, because the material contains a rather rich spora assemblage, too. The planktonic organisms and the scarce Hystricosphaerids indicate a marine environment.

Because of the oscillation of the Tortonian sea, layers of lignite and brown coal and sterile formations alternate in the litoral zone. The lignitic samples are pollen-poor, as was already stated in the description of the zones: in them, tissue remains are predominant throughout. On the other hand, the pollen content of the sterile layers indicates a rich and nearby flora. The important part played by Conifers in the pollen spectrum of the upper part of the zone indicates the proximity of a mountainous terrain.

The oscillation comes to an end at the beginning of the „C“ zone. The distribution of lands and seas was rather constant at that time. A change is indicated by Samples Nos 17 and 16, the land having shifted far away from our locality. The great-distance transport is indicated by some Disaccites.

The spores and Angiosperm pollens indicate of the „D“ zone together with the characteristic Pannonian Disaccites indicate already the presence of an extended land in the neighbourhood. However at our locality the environment was still not terrestrial, as proven by the abundant planktonic organisms, Hystrichosphaerids and Dinoflagellates.

Consequently, when all is said, the data can be utilized to advantage to establish the relative positions of the lands and seas.

VI.

The results of palynology were in the last decades utilized for the purposes of stratigraphical evaluation. In *Hungary*, this purpose was adopted only lately, so that experiences are rather scarce. Therefore, the supplying of rapid results

to the geologist must go hand in hand with fundamental research. This is why I deemed it worth while to try out this new rapid evaluation technique. This first application makes us expect further favorable results.

A further task is to investigate in a similar fashion and to parallelize the samples of borings situated elsewhere in the *Mecsek* Mountains. Only this parallelization will tell in the final reckoning whether this new stratigraphical method gives reliable results under our circumstances.

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